



## TFT LCD Preliminary Specification

# MODEL NO.: V400H1 - LH3

|             |                                              |                          |
|-------------|----------------------------------------------|--------------------------|
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**REVISION HISTORY**

| Version | Date        | Page<br>(New) | Section | Description                                 |
|---------|-------------|---------------|---------|---------------------------------------------|
| Ver 1.0 | Nov. 07,'08 | All           | All     | Preliminary Specification was first issued. |

## 1. GENERAL DESCRIPTION

### 1.1 OVERVIEW

V400H1- LH3 is a 40" TFT Liquid Crystal Display module with 14-CCFL Backlight unit and 2ch-LVDS interface. This module supports 1920 x 1080 FHD format and can display true 1G colors (10-bits/color). The inverter module for backlight is built-in.

### 1.2 FEATURES

- High brightness (500 nits)
- Ultra-high contrast ratio (5000:1)
- Faster response time (Gray to gray average 6.5ms)
- High color saturation NTSC 72%
- Ultra wide viewing angle : 176(H)/176(V) (CR>20) with Super MVA technology
- DE (Data Enable) only mode
- LVDS (Low Voltage Differential Signaling) interface
- Color reproduction (nature color)
- Optimized response time for both 50/60 Hz Frame rate
- Low color shift function
- RoHS compliance

### 1.3 APPLICATION

- TFT LCD TVs
- Multi-Media Display

### 1.4 GENERAL SPECIFICATIONS

| Item                    | Specification                                    | Unit  | Note |
|-------------------------|--------------------------------------------------|-------|------|
| Active Area             | 885.6(H) x 498.15 (V) (40" diagonal)             | mm    | (1)  |
| Bezel Opening Area      | 891.7 (H) x 504.2 (V)                            | mm    |      |
| Driver Element          | a-si TFT active matrix                           | -     |      |
| Pixel Number            | 1920 x R.G.B. x 1080                             | pixel |      |
| Pixel Pitch (Sub Pixel) | 0.15375 (H) x 0.46125 (V)                        | mm    |      |
| Pixel Arrangement       | RGB vertical stripe                              | -     |      |
| Display Colors          | 1G                                               | color |      |
| Display Operation Mode  | Transmissive mode / Normally black               | -     |      |
| Surface Treatment       | Anti-Glare coating (Haze 11%), Hard coating (3H) | -     |      |

### 1.5 MECHANICAL SPECIFICATIONS

| Item        | Min.          | Typ. | Max. | Unit | Note            |
|-------------|---------------|------|------|------|-----------------|
| Module Size | Horizontal(H) | 951  | 952  | 953  | mm (1)          |
|             | Vertical(V)   | 550  | 551  | 552  | mm (1)          |
|             | Depth(D)      | 39.5 | 40.5 | 41.5 | mm To TOP Side  |
|             | Depth(D)      | 49   | 50   | 51   | mm To PCB Cover |
| Weight      | -             | 9550 | -    | g    |                 |

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

## 2. ABSOLUTE MAXIMUM RATINGS

### 2.1 ABSOLUTE RATINGS OF ENVIRONMENT

| Item                          | Symbol           | Value |      | Unit | Note     |
|-------------------------------|------------------|-------|------|------|----------|
|                               |                  | Min.  | Max. |      |          |
| Storage Temperature           | T <sub>ST</sub>  | -20   | +60  | °C   | (1)      |
| Operating Ambient Temperature | T <sub>OP</sub>  | 0     | +50  | °C   | (1), (2) |
| Shock (Non-Operating)         | S <sub>NOP</sub> | -     | 50   | G    | (3), (5) |
| Vibration (Non-Operating)     | V <sub>NOP</sub> | -     | 1.0  | G    | (4), (5) |

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. ( $T_a \leq 40\text{ }^{\circ}\text{C}$ ).

(b) Wet-bulb temperature should be 39 °C Max. ( $T_a > 40\text{ }^{\circ}\text{C}$ ).

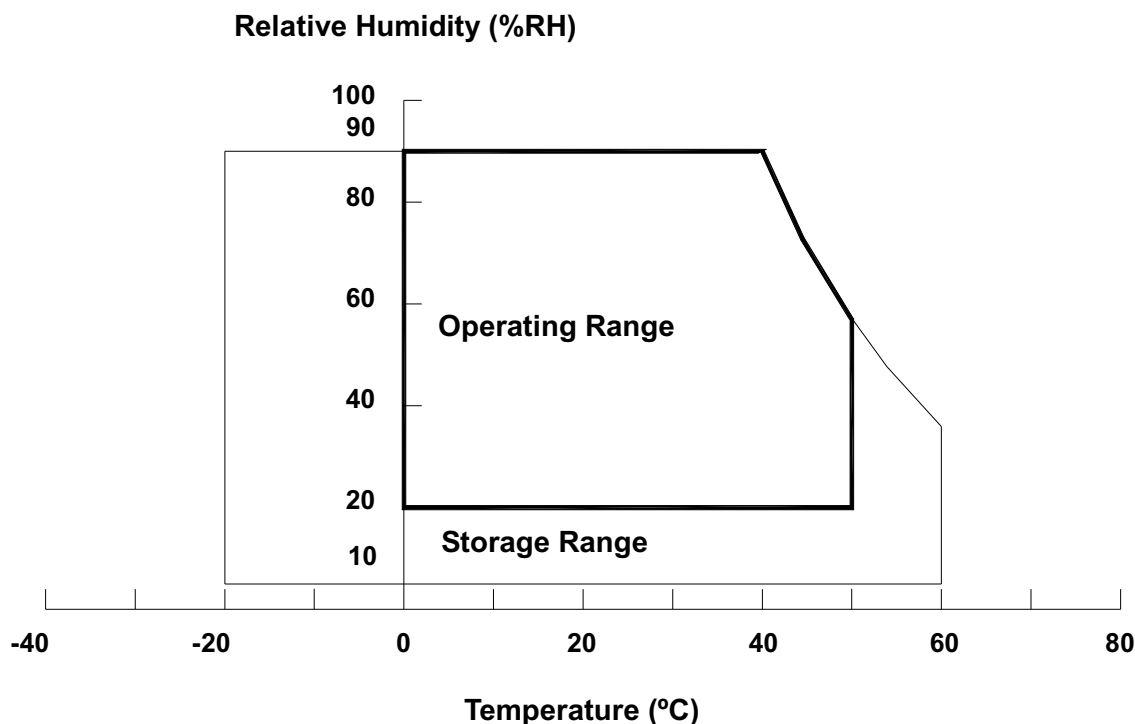
(c) No condensation.

Note (2) The maximum operating temperature is based on the test condition that the surface temperature of display area is less than or equal to 65 °C with LCD module alone in a temperature controlled chamber. Thermal management should be considered in final product design to prevent the surface temperature of display area from being over 65 °C. The range of operating temperature may degrade in case of improper thermal management in final product design.

Note (3) 11 ms, half sine wave, 1 time for  $\pm X$ ,  $\pm Y$ ,  $\pm Z$ .

Note (4) 10 ~ 200 Hz, 10 min, 1 time each X, Y, Z.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.



## 2.2 PACKAGE STORAGE

When storing modules as spares for a long time, the following precaution is necessary.

- (a) Do not leave the module in high temperature, and high humidity for a long time. It is highly recommended to store the module with temperature from 0 to 35 °C at normal humidity without condensation.
- (b) The module shall be stored in dark place. Do not store the TFT-LCD module in direct sunlight or fluorescent light.

## 2.3 ELECTRICAL ABSOLUTE RATINGS

### 2.3.1 TFT LCD MODULE

| Item                 | Symbol          | Value |      | Unit | Note |
|----------------------|-----------------|-------|------|------|------|
|                      |                 | Min.  | Max. |      |      |
| Power Supply Voltage | V <sub>CC</sub> | -0.3  | 13.5 | V    | (1)  |
| Input Signal Voltage | V <sub>IN</sub> | -0.3  | 3.6  | V    |      |

### 2.3.2 BACKLIGHT UNIT

| Item         | Symbol         | Value |      | Unit             | Note |
|--------------|----------------|-------|------|------------------|------|
|              |                | Min.  | Max. |                  |      |
| Lamp Voltage | V <sub>W</sub> | —     | 3000 | V <sub>RMS</sub> |      |

Note (1) No moisture condensation or freezing.

### 3. ELECTRICAL CHARACTERISTICS

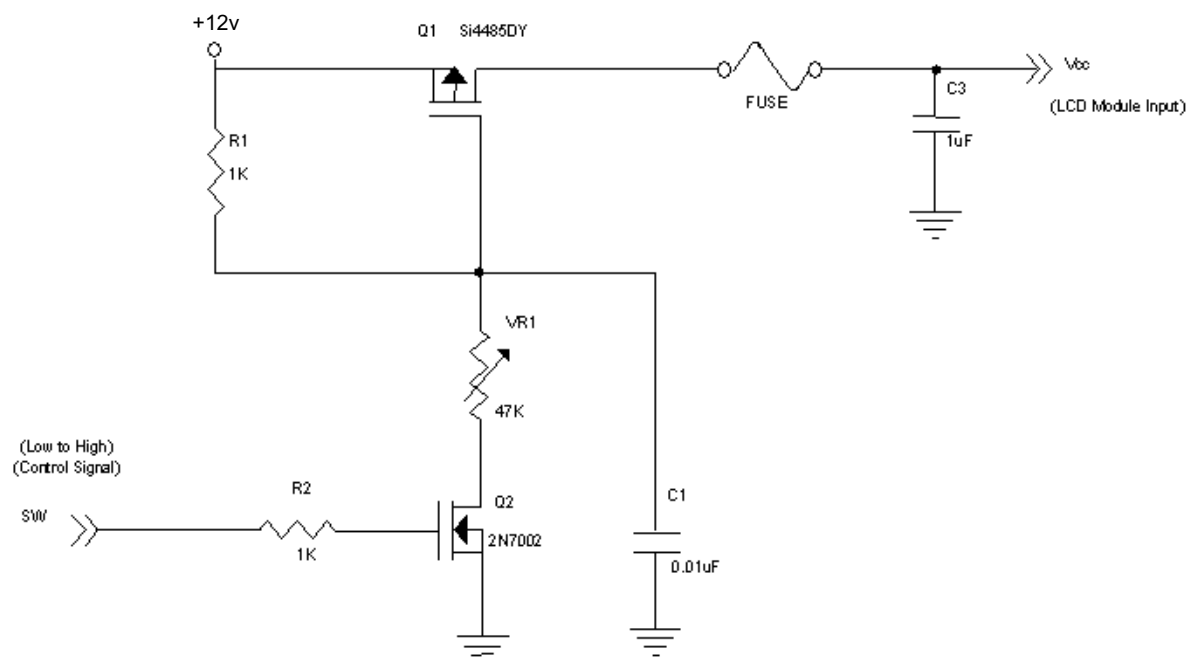
#### 3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

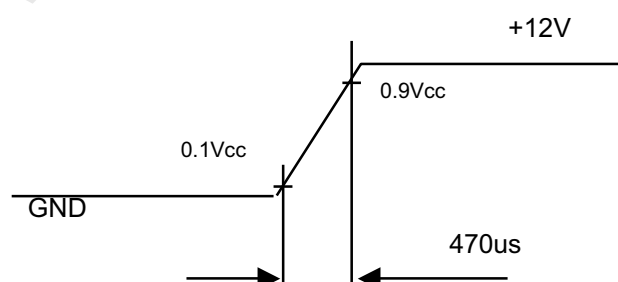
| Parameter                   |                              | Symbol            | Value |      |       | Unit | Note |
|-----------------------------|------------------------------|-------------------|-------|------|-------|------|------|
|                             |                              |                   | Min.  | Typ. | Max.  |      |      |
| Power Supply Voltage        |                              | V <sub>CC</sub>   | 10.8  | 12.0 | 13.2  | V    | (1)  |
| Power Supply Ripple Voltage |                              | V <sub>RP</sub>   | -     | -    | 350   | mV   |      |
| Rush Current                |                              | I <sub>RUSH</sub> | -     | -    | 4.5   | A    | (2)  |
| Power Supply Current        | White                        | I <sub>CC</sub>   | -     | 2.6  | 2.8   | A    | (3)  |
|                             | Black                        |                   | -     | 2    | 2.1   | A    |      |
|                             | Vertical Stripe              |                   | -     | 2.6  | 2.9   | A    |      |
| LVDS Interface              | Common Input Voltage         | V <sub>LVC</sub>  | 1.125 | 1.25 | 1.375 | V    |      |
|                             | Terminating Resistor         | R <sub>T</sub>    | -     | 100  | -     | ohm  |      |
| CMOS interface              | Input High Threshold Voltage | V <sub>IH</sub>   | 2.7   | -    | 3.3   | V    |      |
|                             | Input Low Threshold Voltage  | V <sub>IL</sub>   | 0     | -    | 0.7   | V    |      |

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:

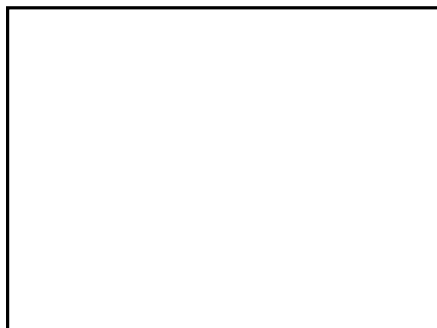


**Vcc rising time is 470us**



Note (3) The specified power supply current is under the conditions at  $V_{CC} = 12\text{ V}$ ,  $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ ,  $f_v = 60\text{ Hz}$ , whereas a power dissipation check pattern below is displayed.

a. White Pattern



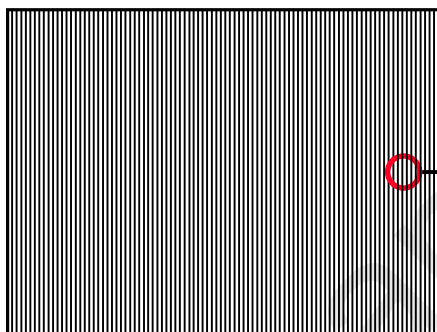
Active Area

b. Black Pattern

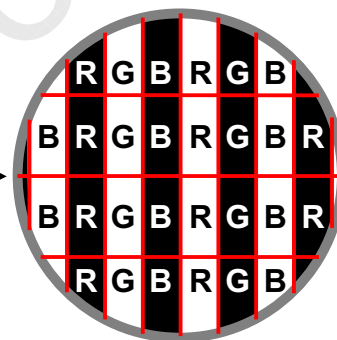


Active Area

c. Vertical Stripe Pattern



Active Area



## 3.2 BACKLIGHT UNIT

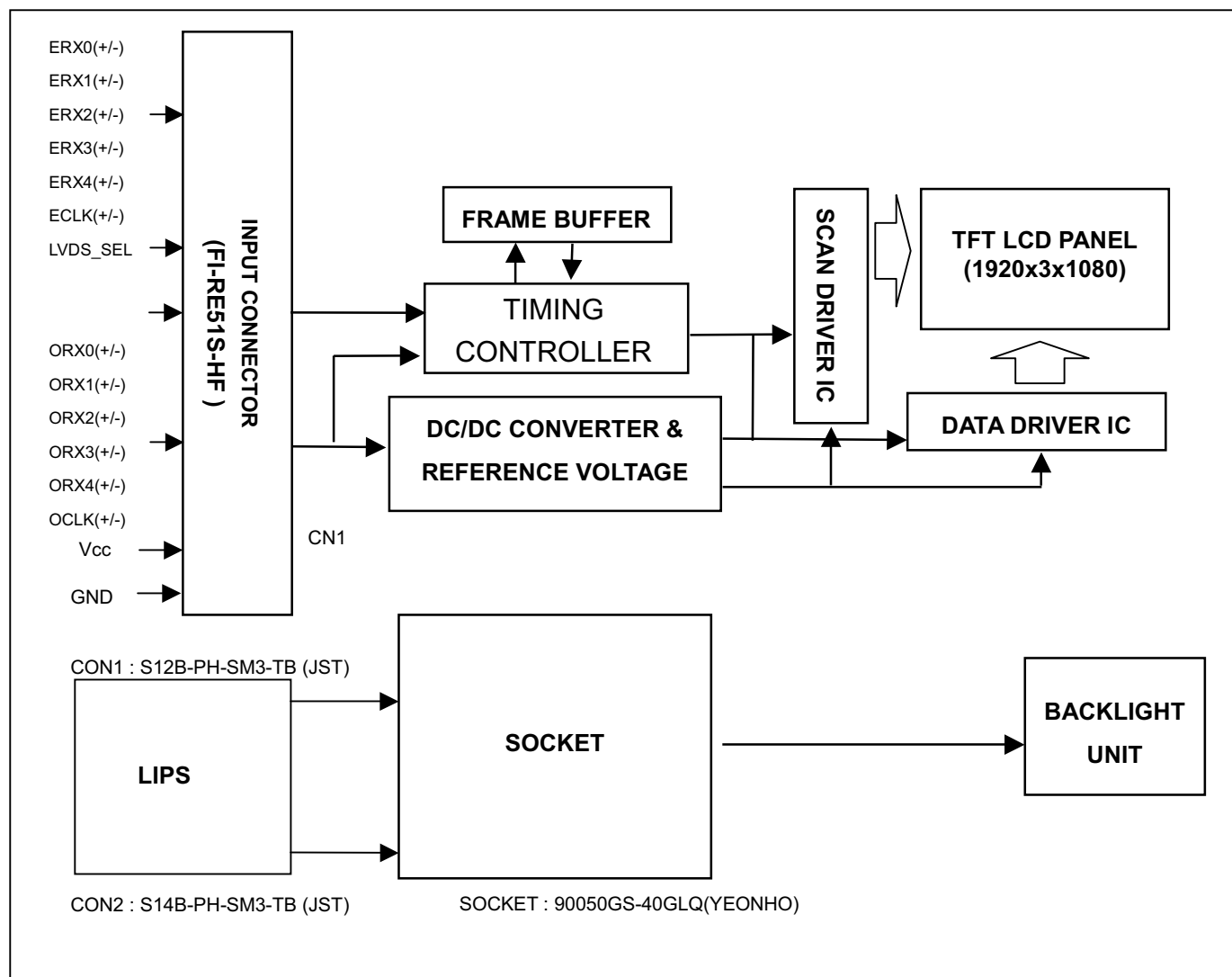
### 3.2.1 CCFL (Cold Cathode Fluorescent Lamp) CHARACTERISTICS ( $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$ )

| Parameter             | Symbol   | Value  |      |      | Unit              | Note                                    |
|-----------------------|----------|--------|------|------|-------------------|-----------------------------------------|
|                       |          | Min.   | Typ. | Max. |                   |                                         |
| Lamp Voltage          | $V_W$    | -      | 1020 | -    | $V_{RMS}$         | $I_h = 11.0\text{mA}$                   |
| Lamp Current          | $I_L$    | 10.7   | 11.0 | 11.3 | $\text{mA}_{RMS}$ | (1)                                     |
| Lamp Starting Voltage | $V_S$    | -      | -    | 1680 | $V_{RMS}$         | (2), $T_a = 0\text{ }^{\circ}\text{C}$  |
|                       |          | -      | -    | 1400 | $V_{RMS}$         | (2), $T_a = 25\text{ }^{\circ}\text{C}$ |
| Operating Frequency   | $F_O$    | 30     | -    | 80   | $\text{kHz}$      | (3)                                     |
| Lamp Life Time        | $L_{BL}$ | 50,000 | -    | -    | Hrs               | (4), at 11.5mA                          |



## 4. BLOCK DIAGRAM

### 4.1 TFT LCD MODULE





## 5. INTERFACE PIN CONNECTION

### 5.1 TFT LCD MODULE

#### CN505 Connector Pin Assignment

| Pin No. | Symbol       | Description                                  |
|---------|--------------|----------------------------------------------|
| 1       | VIN          | +12.0V power supply                          |
| 2       | VIN          | +12.0V power supply                          |
| 3       | VIN          | +12.0V power supply                          |
| 4       | VIN          | +12.0V power supply                          |
| 5       | VIN          | +12.0V power supply                          |
| 6       | NC           | No connection                                |
| 7       | GND          | Ground                                       |
| 8       | GND          | Ground                                       |
| 9       | GND          | Ground                                       |
| 10      | ODD_RIN0N    | Negative transmission data of First pixel 0  |
| 11      | ODD_RIN0P    | Positive transmission data of First pixel 0  |
| 12      | ODD_RIN1N    | Negative transmission data of First pixel 1  |
| 13      | ODD_RIN1P    | Positive transmission data of First pixel 1  |
| 14      | ODD_RIN2N    | Negative transmission data of First pixel 2  |
| 15      | ODD_RIN2P    | Positive transmission data of First pixel 2  |
| 16      | GND          | Ground                                       |
| 17      | ODD_RINCLKN  | Negative of First clock                      |
| 18      | ODD_RINCLKP  | Positive of First clock                      |
| 19      | GND          | Ground                                       |
| 20      | ODD_RIN3N    | Negative transmission data of First pixel 3  |
| 21      | ODD_RIN3P    | Positive transmission data of First pixel 3  |
| 22      | ODD_RIN4N    | Negative transmission data of First pixel 4  |
| 23      | ODD_RIN4P    | Positive transmission data of First pixel 4  |
| 24      | GND          | Ground                                       |
| 25      | EVEN_RIN0N   | Negative transmission data of Second pixel 0 |
| 26      | EVEN_RIN0P   | Positive transmission data of Second pixel 0 |
| 27      | EVEN_RIN1N   | Negative transmission data of Second pixel 1 |
| 28      | EVEN_RIN1P   | Positive transmission data of Second pixel 1 |
| 29      | EVEN_RIN2N   | Negative transmission data of Second pixel 2 |
| 30      | EVEN_RIN2P   | Positive transmission data of Second pixel 2 |
| 31      | GND          | Ground                                       |
| 32      | EVEN_RINCLKN | Negative of Second clock                     |
| 33      | EVEN_RINCLKP | Positive of Second clock                     |
| 34      | GND          | Ground                                       |
| 35      | EVEN_RIN3N   | Negative transmission data of Second pixel 3 |
| 36      | EVEN_RIN3P   | Positive transmission data of Second pixel 3 |
| 37      | EVEN_RIN4N   | Negative transmission data of Second pixel 4 |
| 38      | EVEN_RIN4P   | Positive transmission data of Second pixel 4 |
| 39      | GND          | Ground                                       |
| 40      | SCL_I        | SEC define                                   |
| 41      | SDA_I        | SEC define                                   |



|    |            |               |
|----|------------|---------------|
| 42 | TCON_CHECK | SEC define    |
| 43 | TST_PGM    | SEC define    |
| 44 | HSYNC      | SEC define    |
| 45 | LVDS_SEL   | SEC define    |
| 46 | I2C_SCL    | SEC define    |
| 47 | FRC_NRESET | SEC define    |
| 48 | I2C_SDA    | SEC define    |
| 49 | SW_PVCC    | SEC define    |
| 50 | MAIN_CHECK | SEC define    |
| 51 | NC         | No connection |

Note (1) CN505 Connector Part No.: JAE Taiwan (台灣航空電子) FI-RE51S-HF or equal.

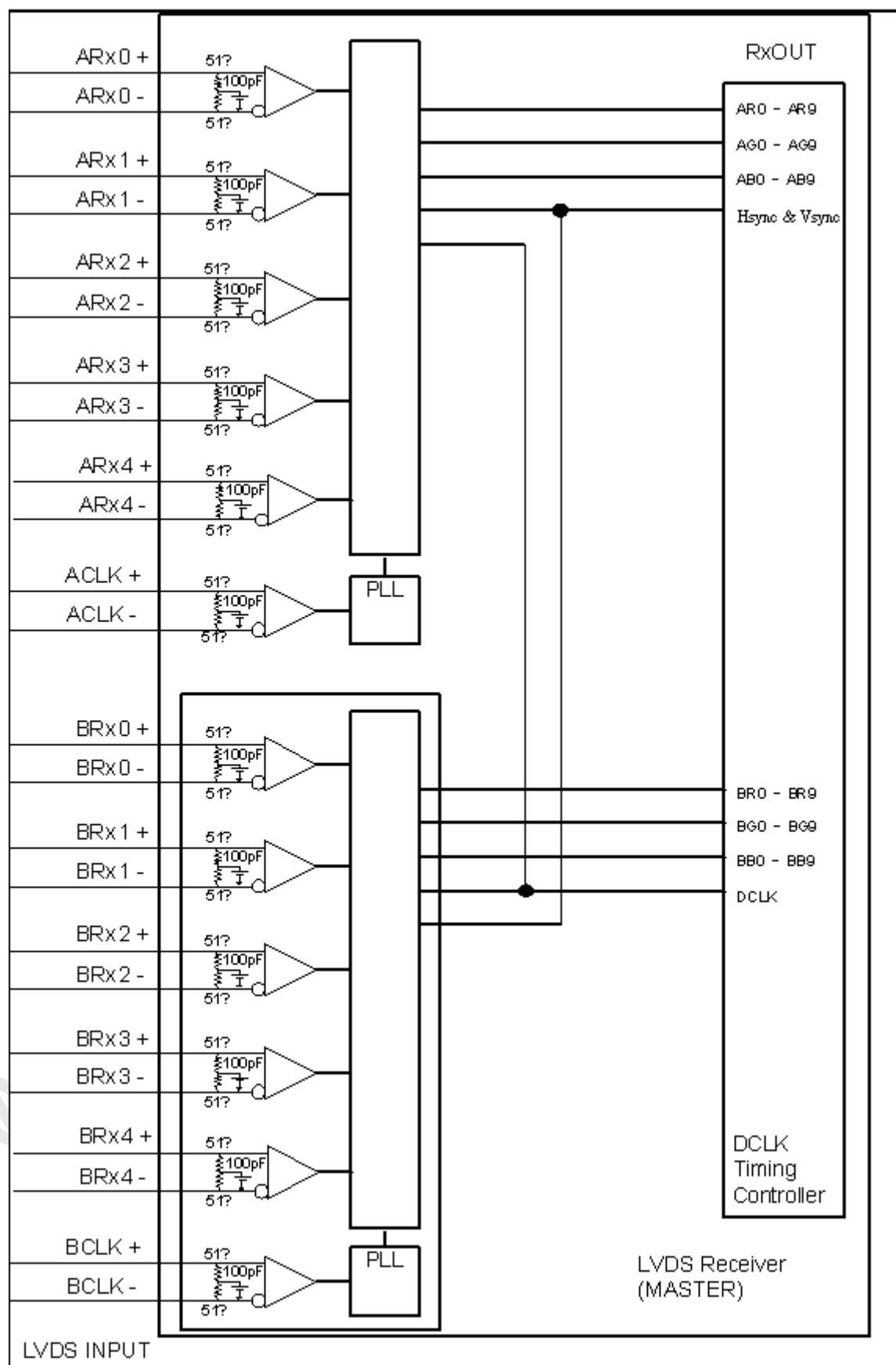
## 5.2 BACKLIGHT UNIT

The pin configuration for the housing and leader wire is shown in the table below.

| Pin No. | Symbol | Description | Wire Color |
|---------|--------|-------------|------------|
| NA      | NA     | NA          | NA         |
|         |        |             |            |

Note (1) The backlight interface housing for high voltage side is a model 90050GS-40GLQ (SOCKET), manufactured by YEONHO.



**5.3 BLOCK DIAGRAM OF INTERFACE**

ER0~ER9 : Even pixel R data

EG0~EG9 : Even pixel G data

EB0~EB9 : Even pixel B data

OR0~OR9: Odd pixel R data

OG0~OG9: Odd pixel G data

OB0~OB9 : Odd pixel B data

DE : Data enable signal

DCLK : Data clock signal

Note (1) The system must have the transmitter to drive the module.

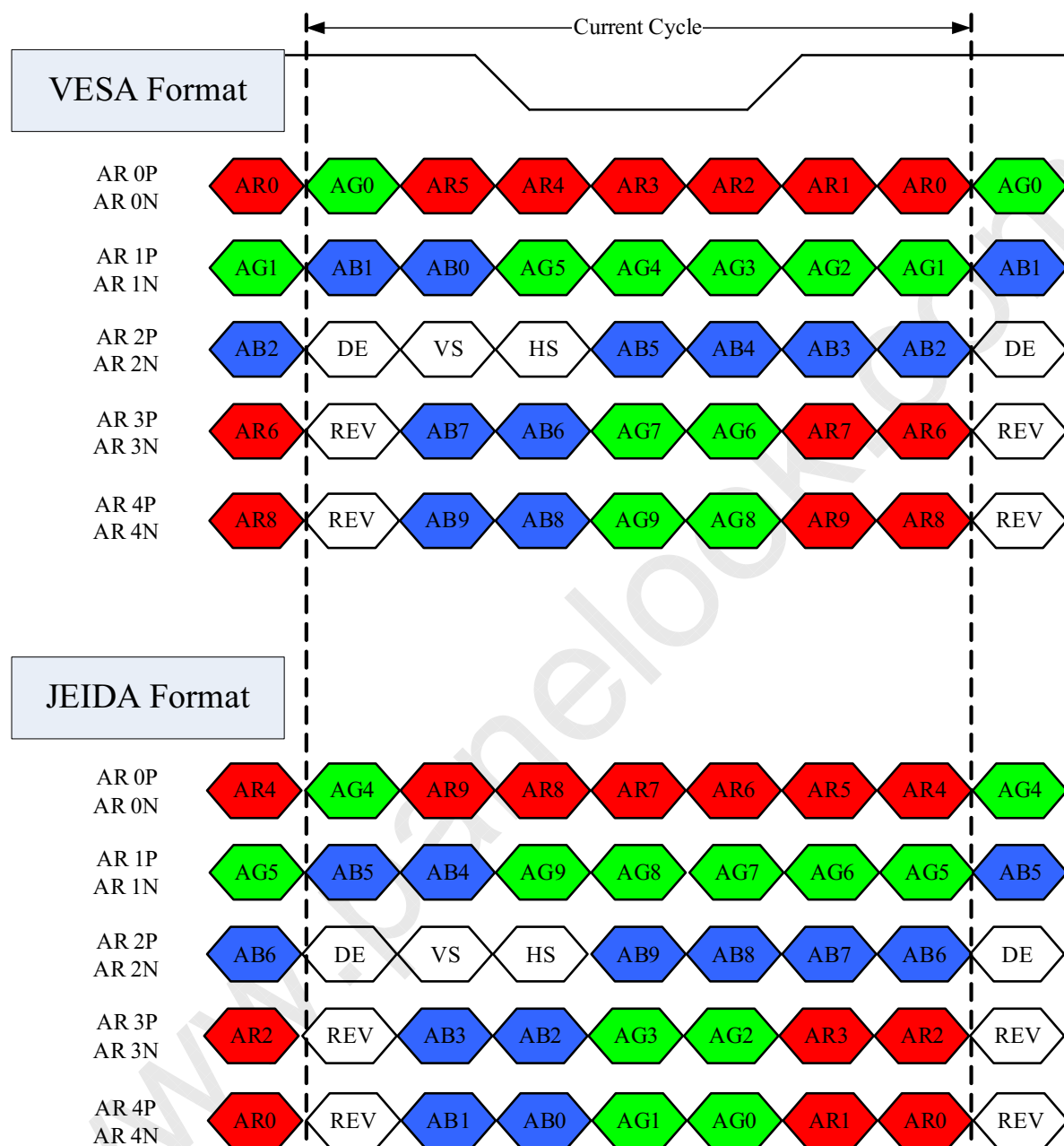
Note (2) LVDS cable impedance shall be 50 ohms per signal line or about 100 ohms per twist-pair line when it is used differentially.

Note (3) Two pixel data send into the module for every clock cycle. The first pixel of the frame is odd pixel and the second pixel is even pixel.

## 5.4 LVDS INTERFACE

VESA Format : SELLVDS = H or Open

JEIDA Format : SELLVDS = L



AR0~AR9: First Pixel R Data (9; MSB, 0; LSB)

AG0~AG9: First Pixel G Data (9; MSB, 0; LSB)

AB0~AB9: First Pixel B Data (9; MSB, 0; LSB)

DE : Data enable signal

DCLK : Data clock signal

RSVD : Reserved



## 5.5 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 10-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

| Color               |                  | Data Signal |    |    |    |    |    |    |    |    |    |       |    |    |    |    |    |    |    |    |    |      |    |    |    |    |    |
|---------------------|------------------|-------------|----|----|----|----|----|----|----|----|----|-------|----|----|----|----|----|----|----|----|----|------|----|----|----|----|----|
|                     |                  | Red         |    |    |    |    |    |    |    |    |    | Green |    |    |    |    |    |    |    |    |    | Blue |    |    |    |    |    |
|                     |                  | R9          | R8 | R7 | R6 | R5 | R4 | R3 | R2 | R1 | R0 | G9    | G8 | G7 | G6 | G5 | G4 | G3 | G2 | G1 | G0 | B9   | B8 | B7 | B6 | B5 | B4 |
| Basic Colors        | Black            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red              | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green            | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Blue             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | Cyan             | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | Magenta          | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |
|                     | White            | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1    | 1  | 1  | 1  | 1  | 1  |
| Gray Scale Of Red   | Red (0) / Dark   | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red (1)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red (2)          | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Red (1021)       | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Red (1022)       | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
| Gray Scale Of Green | Red (1023)       | 1           | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green (0) / Dark | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green (1)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green (2)        | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Green (1021)     | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 1    | 0  | 0  | 0  | 0  | 0  |
| Gray Scale Of Blue  | Green (1022)     | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Green (1023)     | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1  | 1     | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 1  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Blue (0) / Dark  | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 0  |
|                     | Blue (1)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 1  |
|                     | Blue (2)         | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0    | 0  | 0  | 0  | 0  | 1  |
|                     | :                | :           | :  | :  | :  | :  | :  | :  | :  | :  | :  | :     | :  | :  | :  | :  | :  | :  | :  | :  | :  | :    | :  | :  | :  | :  | :  |
|                     | Blue (1021)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 0  |
| Gray Scale Of Blue  | Blue (1022)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 0  |
|                     | Blue (1023)      | 0           | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0     | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 0  | 1    | 1  | 1  | 1  | 1  | 1  |

Note (1) 0: Low Level Voltage, 1: High Level Voltage



## 6. INTERFACE TIMING

### 6.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

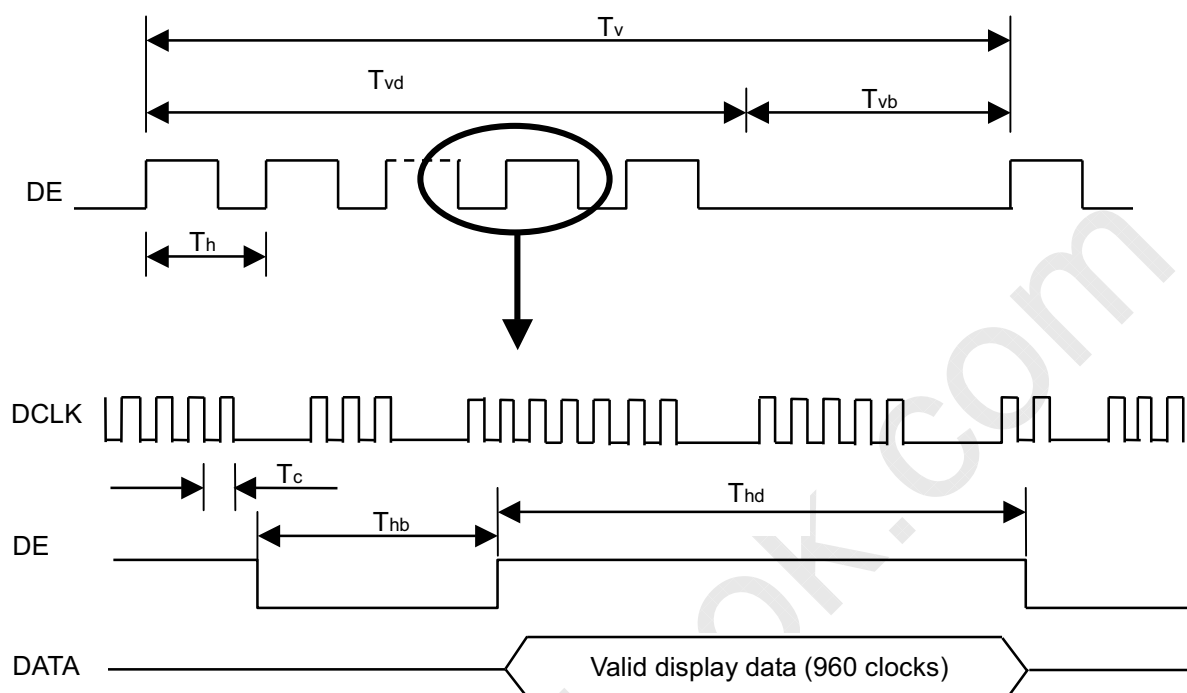
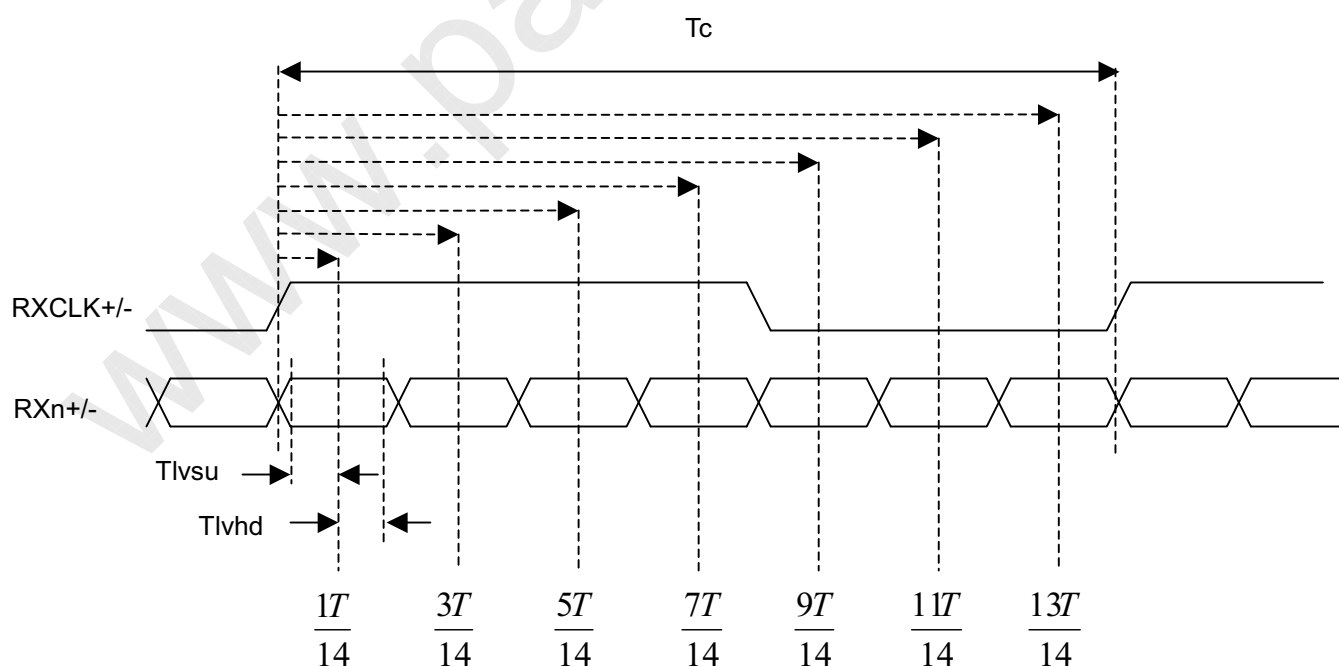
| Signal                         | Item       | Symbol | Min.  | Typ.  | Max.  | Unit | Note       |
|--------------------------------|------------|--------|-------|-------|-------|------|------------|
| LVDS Receiver Clock            | Frequency  | 1/Tc   | -     | 74    | -     | MHz  |            |
| Hsync                          |            | Fh     | -     | 67.5  | -     | KHz  |            |
| Vsync                          |            | Fv     | -     | 59.94 | -     | Hz   |            |
| LVDS Receiver Data             | Setup Time | Tlvsu  | 600   | -     | -     | ps   |            |
|                                | Hold Time  | Tlvhd  | 600   | -     | -     | ps   |            |
| Vertical Active Display Term   | Frame Rate | Fr6    | 57    | 60    | 63    | Hz   |            |
|                                | Total      | Tv     | (TBD) | 1125  | (TBD) | Th   | Tv=Tvd+Tvb |
|                                | Display    | Tvd    | (TBD) | 1080  | (TBD) | Th   | -          |
|                                | Blank      | Tvb    | (TBD) | 45    | (TBD) | Th   | -          |
| Horizontal Active Display Term | Total      | Th     | (TBD) | 2200  | (TBD) | Tc   | Th=Thd+Thb |
|                                | Display    | Thd    | (TBD) | 1920  | (TBD) | Tc   | -          |
|                                | Blank      | Thb    | (TBD) | 280   | (TBD) | Tc   | -          |

### 6.2 INTERNAL SIGNAL TIMING SPECIFICATIONS (FRC→ T-CON)

The input signal timing specifications are shown as the following table and timing diagram.

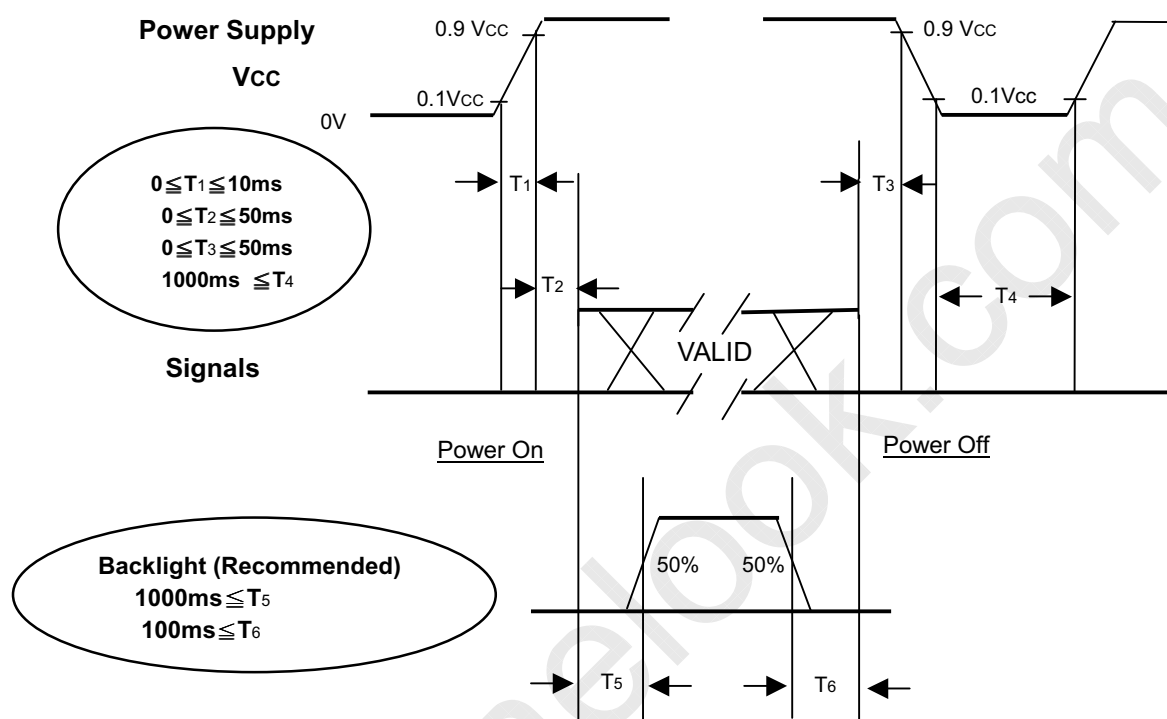
| Signal                         | Item       | Symbol | Min. | Typ. | Max. | Unit | Note       |
|--------------------------------|------------|--------|------|------|------|------|------------|
| LVDS Receiver Clock            | Frequency  | 1/Tc   | 60   | 74   | 80   | MHz  |            |
| Hsync                          |            | Fh     | -    | 135  | -    | KHz  |            |
| Vsync                          |            | Fv     | -    | 120  | -    | Hz   |            |
| LVDS Receiver Data             | Setup Time | Tlvsu  | 600  | -    | -    | ps   |            |
|                                | Hold Time  | Tlvhd  | 600  | -    | -    | ps   |            |
| Vertical Active Display Term   | Frame Rate | Fr6    | -    | 120  | -    | Hz   |            |
|                                | Total      | Tv     | 1115 | 1125 | 1139 | Th   | Tv=Tvd+Tvb |
|                                | Display    | Tvd    | 1080 | 1080 | 1080 | Th   | -          |
|                                | Blank      | Tvb    | 35   | 45   | 59   | Th   | -          |
| Horizontal Active Display Term | Total      | Th     | 540  | 550  | 575  | Tc   | Th=Thd+Thb |
|                                | Display    | Thd    | 480  | 480  | 480  | Tc   | -          |
|                                | Blank      | Thb    | 60   | 70   | 95   | Tc   | -          |

. Note : Since the module is operated in DE only mode, Hsync and Vsync input signals should be set to low logic level. Otherwise, this module would operate abnormally.

**INPUT SIGNAL TIMING DIAGRAM****LVDS RECEIVER INTERFACE TIMING DIAGRAM**

### 6.3 POWER ON/OFF SEQUENCE

To prevent a latch-up or DC operation of LCD module, the power on/off sequence should be as the diagram below.



**Power ON/OFF Sequence**

Note (1) The supply voltage of the external system for the module input should follow the definition of Vcc.

Note (2) Apply the lamp voltage within the LCD operation range. When the backlight turns on before the LCD operation or the LCD turns off before the backlight turns off, the display may momentarily become abnormal screen.

Note (3) In case of Vcc is in off level, please keep the level of input signals on the low or high impedance.

Note (4) T4 should be measured after the module has been fully discharged between power off and on period.

Note (5) Interface signal shall not be kept at high impedance when the power is on.

## 7. OPTICAL CHARACTERISTICS

### 7.1 TEST CONDITIONS

| Item                                     | Symbol                                                        | Value     | Unit |
|------------------------------------------|---------------------------------------------------------------|-----------|------|
| Ambient Temperature                      | Ta                                                            | 25±2      | °C   |
| Ambient Humidity                         | Ha                                                            | 50±10     | %RH  |
| Supply Voltage                           | V <sub>CC</sub>                                               | 12        | V    |
| Input Signal                             | According to typical value in "3. ELECTRICAL CHARACTERISTICS" |           |      |
| Lamp Current(HV)                         | I <sub>L</sub>                                                | 8.0 ± 0.3 | mA   |
| Oscillating Frequency<br>(Balance Board) | F <sub>w</sub>                                                | 48±3      | KHz  |
| Frame rate                               |                                                               | 60        | Hz   |

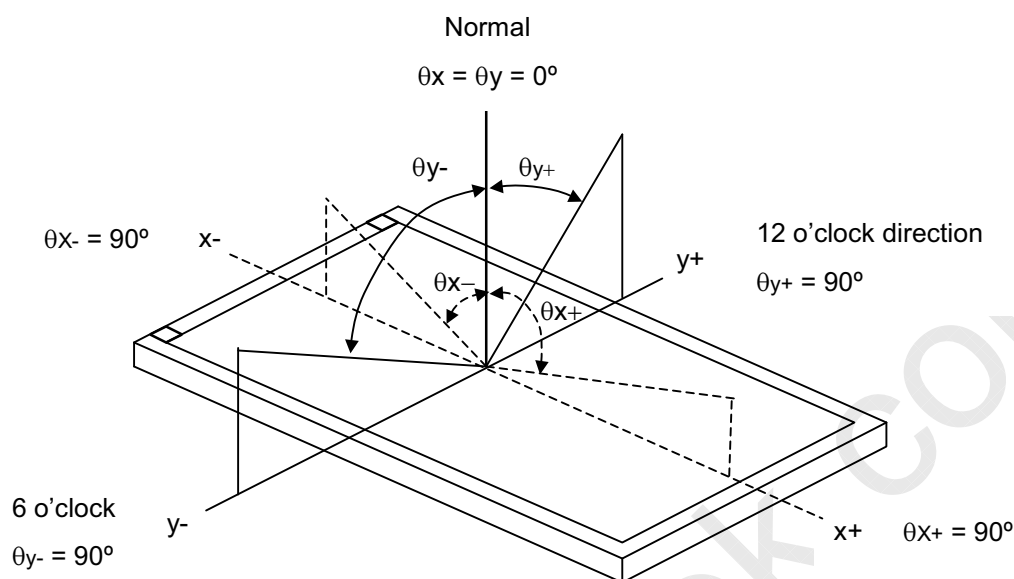
### 7.2 OPTICAL SPECIFICATIONS

The relative measurement methods of optical characteristics are shown in 7.2. The following items should be measured under the test conditions described in 7.1 and stable environment shown in Note (6).

| Item                      |             | Symbol                  | Condition                                                                    | Min.           | Typ.  | Max.           | Unit | Note |
|---------------------------|-------------|-------------------------|------------------------------------------------------------------------------|----------------|-------|----------------|------|------|
| Contrast Ratio            |             | CR                      | $\theta_x=0^\circ, \theta_y=0^\circ$<br>Viewing angle at<br>Normal direction | 4000           | 5000  | -              | -    | (2)  |
| Response Time             |             | Gray to gray<br>average |                                                                              | -              | 6.5   | 12             | ms   | (3)  |
| Center Luminance of White |             | L <sub>c</sub>          |                                                                              | 450            | 500   | -              | cd/  | (4)  |
| White Variation           |             | $\delta W$              |                                                                              | -              | -     | 1.3            | -    | (7)  |
| Cross Talk                |             | CT                      |                                                                              | -              | -     | 4.0            | %    | (5)  |
| Color<br>Chromaticity     | Red         | R <sub>x</sub>          |                                                                              | Typ. -<br>0.03 | 0.635 | Typ. +<br>0.03 | -    | (6)  |
|                           |             | R <sub>y</sub>          |                                                                              |                | 0.323 |                | -    |      |
|                           | Green       | G <sub>x</sub>          |                                                                              |                | 0.285 |                | -    |      |
|                           |             | G <sub>y</sub>          |                                                                              |                | 0.602 |                | -    |      |
|                           | Blue        | B <sub>x</sub>          |                                                                              |                | 0.148 |                | -    |      |
|                           |             | B <sub>y</sub>          |                                                                              |                | 0.056 |                | -    |      |
|                           | White       | W <sub>x</sub>          |                                                                              |                | 0.280 |                | -    |      |
|                           |             | W <sub>y</sub>          |                                                                              |                | 0.290 |                | -    |      |
|                           | Color Gamut | CG                      |                                                                              | 70             | 72    |                | %    | NTSC |
| Viewing<br>Angle          | Horizontal  | $\theta_{x+}$           | CR≥20                                                                        | 80             | 88    | -              | Deg  | (1)  |
|                           |             | $\theta_{x-}$           |                                                                              | 80             | 88    | -              |      |      |
|                           | Vertical    | $\theta_{y+}$           |                                                                              | 80             | 88    | -              |      |      |
|                           |             | $\theta_{y-}$           |                                                                              | 80             | 88    | -              |      |      |
|                           |             |                         |                                                                              |                |       |                |      |      |

Note (1) Definition of Viewing Angle ( $\theta_x$ ,  $\theta_y$ ):

Viewing angles are measured by EZ-Contrast 160R (Eldim)



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

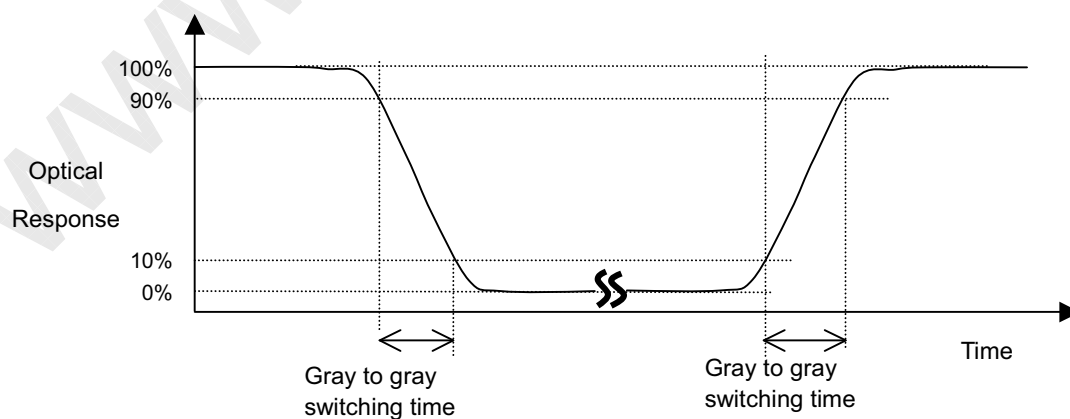
$$\text{Contrast Ratio (CR)} = L_{255} / L_0$$

L255: Luminance of gray level 255

L 0: Luminance of gray level 0

CR = CR (5), where CR (X) is corresponding to the Contrast Ratio of the point X at the figure in Note (7).

Note (3) Definition of Gray to Gray Switching Time :



The driving signal means the signal of gray level 0, 63, 127, 191, 255.

Gray to gray average time means the average switching time of gray level 0, 63, 127, 191, 255 to each other.

Note (4) Definition of Luminance of White ( $L_C$ ,  $L_{AVE}$ ):

Measure the luminance of gray level 255 at center point and 5 points

$$L_C = L(5)$$

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

where  $L(x)$  is corresponding to the luminance of the point  $x$  at the figure in Note (7).

Note (5) Definition of Cross Talk (CT):

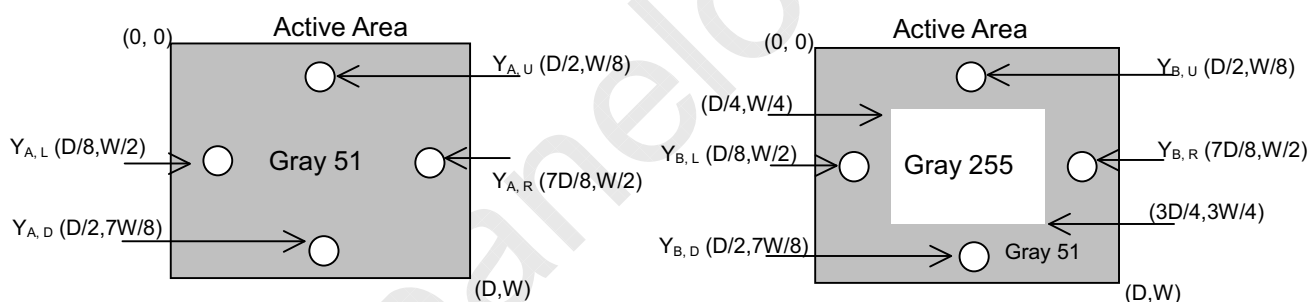
$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where:

(a)

$Y_A$  = Luminance of measured location without gray level 255 pattern ( $\text{cd/m}^2$ )

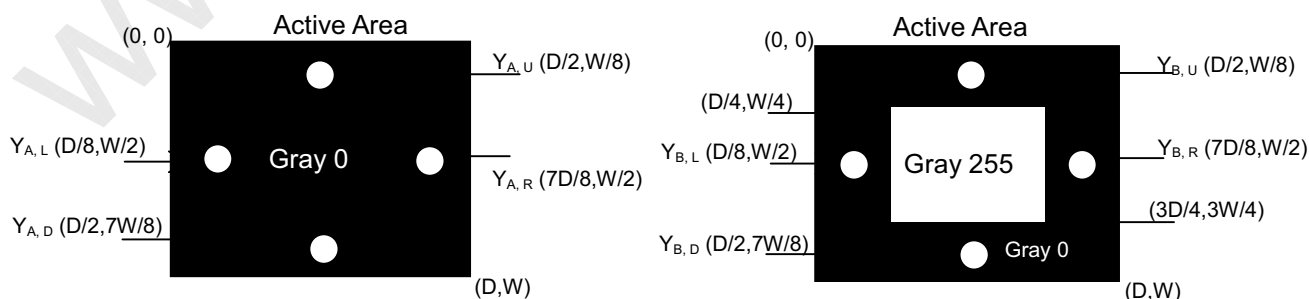
$Y_B$  = Luminance of measured location with gray level 255 pattern ( $\text{cd/m}^2$ )



(b)

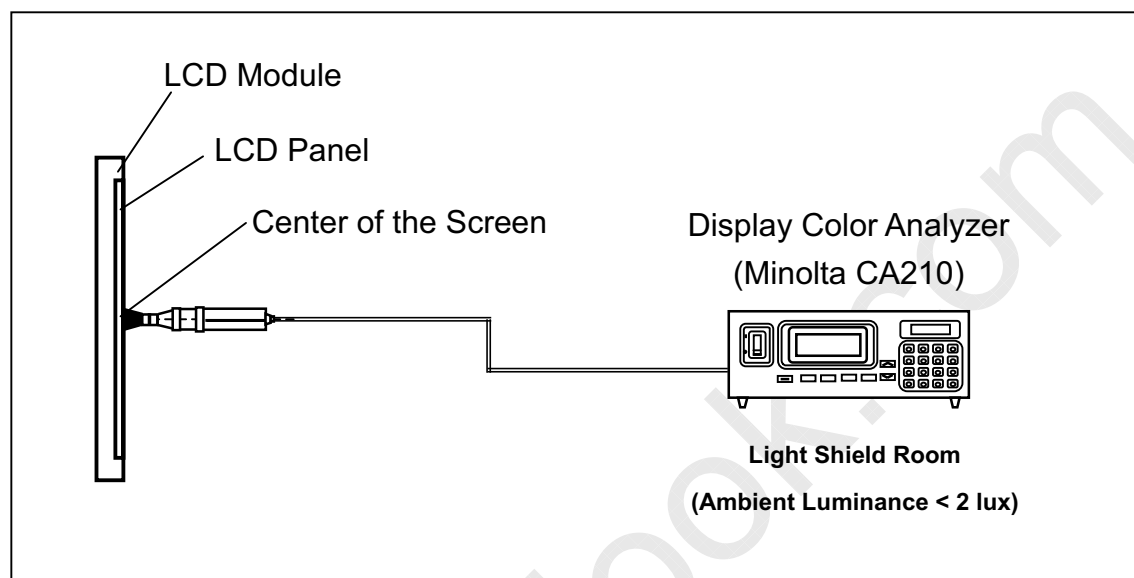
$Y_A$  = Luminance of measured location without gray level 255 pattern ( $\text{cd/m}^2$ )

$Y_B$  = Luminance of measured location with gray level 255 pattern ( $\text{cd/m}^2$ )



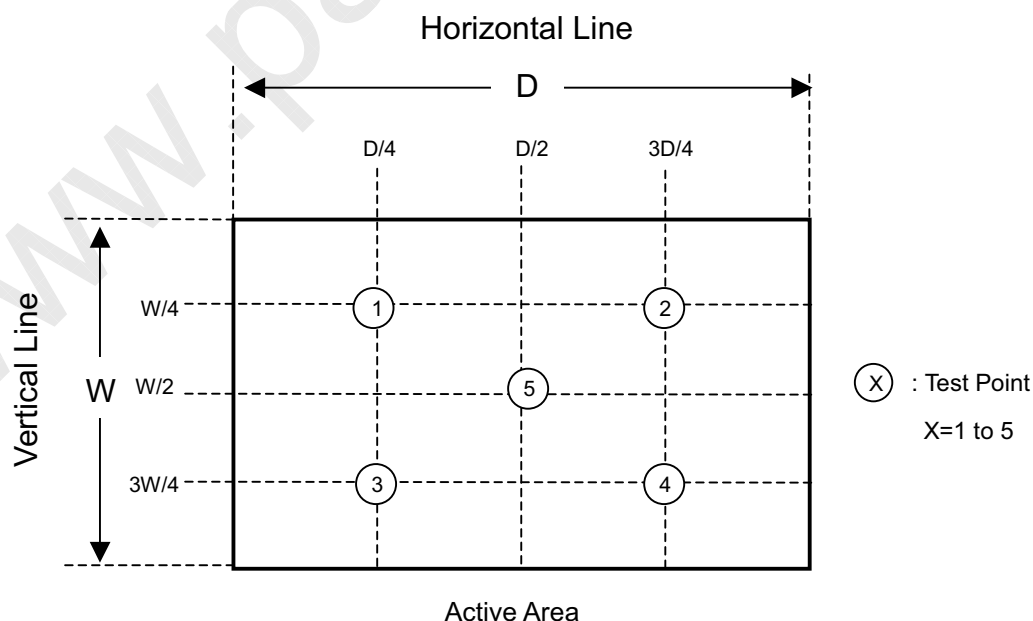
**Note (6) Measurement Setup:**

The LCD module should be stabilized at given temperature for 1 hour to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 1 hour in a windless room.


**Note (7) Definition of White Variation ( $\delta W$ ):**

Measure the luminance of gray level 255 at 5 points

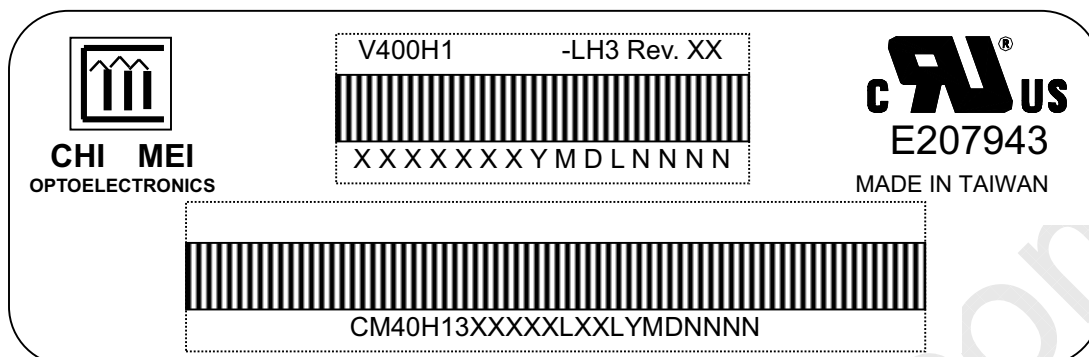
$$\delta W = \text{Maximum} [L(1), L(2), L(3), L(4), L(5)] / \text{Minimum} [L(1), L(2), L(3), L(4), L(5)]$$



## 8. DEFINITION OF LABELS

### 8.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: V400H1-LH3  
 (b) Revision: Rev. XX, for example: A0, A1... B1, B2... or C1, C2...etc.  
 (c) CMO barcode definition:

Serial ID: XX-XX-X-XX-YMD-L-NNNN

| Code | Meaning          | Description                                                                                                                                                                               |
|------|------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| XX   | CMO internal use | -                                                                                                                                                                                         |
| XX   | Revision         | Cover all the change                                                                                                                                                                      |
| X-XX | CMO internal use | -                                                                                                                                                                                         |
| YMD  | Year, month, day | Year: 2001=1, 2002=2, 2003=3, 2004=4...<br>Month: Jan. ~ Dec.=1, 2, 3, ~, 9, A, B, C<br>Day: 1 <sup>st</sup> to 31 <sup>st</sup> =1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U |
| L    | Product line #   | Line 1=1, Line 2=2, Line 3=3, ...                                                                                                                                                         |
| NNNN | Serial number    | Manufacturing sequence of product                                                                                                                                                         |

- (d) Customer's barcode definition:

Serial ID: CM-40H13-X-X-X-XX-L-XX-L-YMD-NNNN

| Code  | Meaning               | Description                                                                                                                                                                                                       |
|-------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CM    | Supplier code         | CMO=CM                                                                                                                                                                                                            |
| 40H13 | Model number          | V400H1-LH3=40H13                                                                                                                                                                                                  |
| X     | Revision code         | C1=A, C2=B, .....C9=I                                                                                                                                                                                             |
| X     | Source driver IC code | Century=1, CLL=2, Demos=3, Epson=4, Fujitsu=5, Himax=6, Hitachi=7, Hynix=8, LDI=9, Matsushita=A, NEC=B, Novatec=C, OKI=D, Philips=E, Renasas=F, Samsung=G, Sanyo=H, Sharp=I, TI=J, Topro=K, Toshiba=L, Windbond=M |
| X     | Gate driver IC code   |                                                                                                                                                                                                                   |
| XX    | Cell location         | Tainan, Taiwan=TN                                                                                                                                                                                                 |
| L     | Cell line #           | 1~12=0~C                                                                                                                                                                                                          |
| XX    | Module location       | Tainan, Taiwan=TN                                                                                                                                                                                                 |
| L     | Module line #         | 1~12=0~C                                                                                                                                                                                                          |
| YMD   | Year, month, day      | Year: 2001=1, 2002=2, 2003=3, 2004=4...<br>Month: Jan. ~ Dec.=1, 2, 3, ~, 9, A, B, C<br>Day: 1 <sup>st</sup> to 31 <sup>st</sup> =1, 2, 3, ~, 9, A, B, C, ~, W, X, Y, exclude I, O, and U                         |
| NNNN  | Serial number         | By LCD supplier                                                                                                                                                                                                   |



## 9. PACKAGING

### 9.1 PACKING SPECIFICATIONS

- (1) 4 LCD TV modules / 1 Box
- (2) Box dimensions : 1040(L) X 310 (W) X 640(H)
- (3) Weight : approximately 47Kg ( 4 modules per box)

### 9.2 PACKING METHOD

Figures 9-1 and 9-2 are the packing method

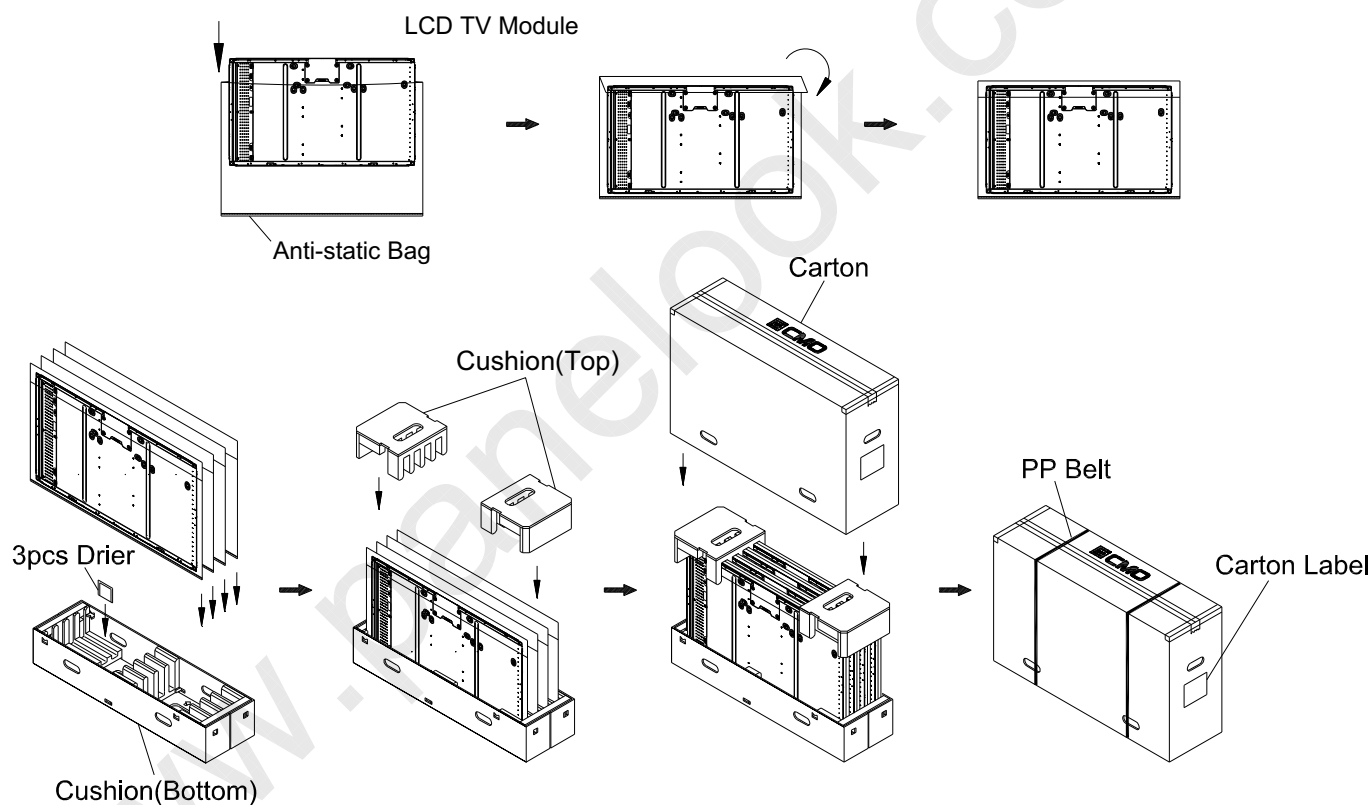
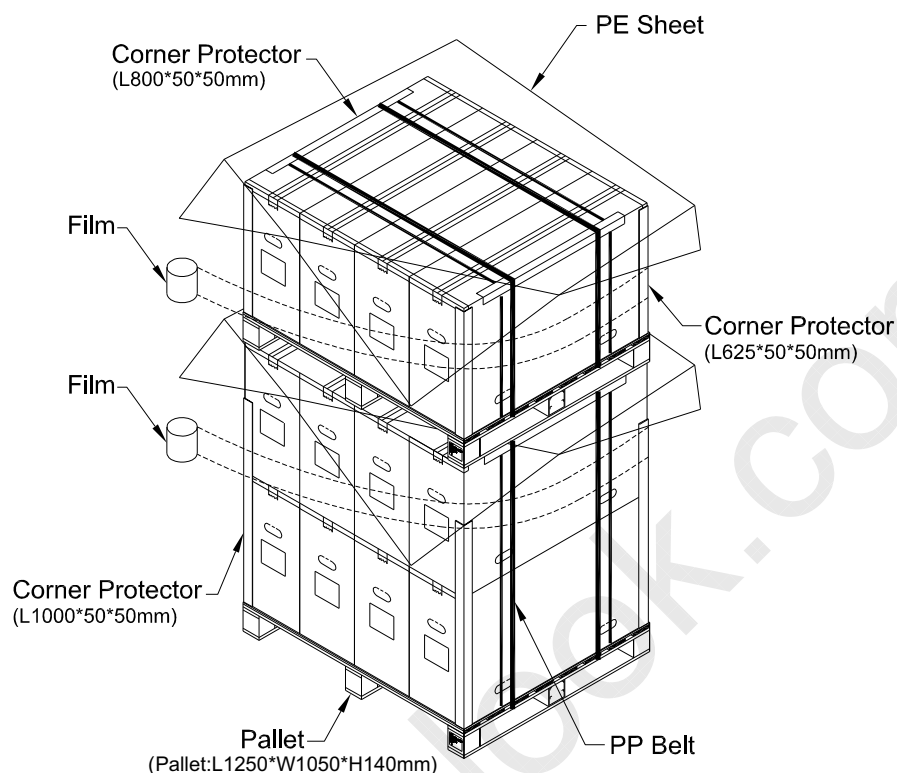


Figure.9-1 packing method



## Sea / Land Transportation (40ft Container)



## Air Transportation

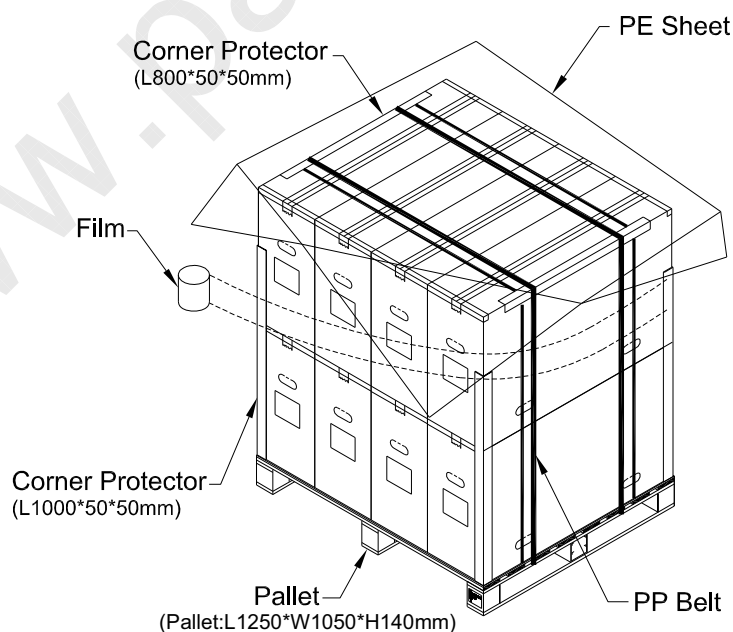


Figure. 9-2 Packing method

## 10. PRECAUTIONS

### 10.1 ASSEMBLY AND HANDLING PRECAUTIONS

- (1) Do not apply rough force such as bending or twisting to the module during assembly.
- (2) It is recommended to assemble or to install a module into the user's system in clean working areas.  
The dust and oil may cause electrical short or worsen the polarizer.
- (3) Do not apply pressure or impulse to the module to prevent the damage of LCD panel and backlight.
- (4) Always follow the correct power-on sequence when the LCD module is turned on. This can prevent the damage and latch-up of the CMOS LSI chips.
- (5) Do not plug in or pull out the I/F connector while the module is in operation.
- (6) Do not disassemble the module.
- (7) Use a soft dry cloth without chemicals for cleaning, because the surface of polarizer is very soft and easily scratched.
- (8) Moisture can easily penetrate into LCD module and may cause the damage during operation.
- (9) High temperature or humidity may deteriorate the performance of LCD module. Please store LCD modules in the specified storage conditions.
- (10) When ambient temperature is lower than 10°C, the display quality might be reduced. For example, the response time will become slow, and the starting voltage of CCFL will be higher than that of room temperature.

### 10.2 SAFETY PRECAUTIONS

- (1) The startup voltage of a backlight is over 1000 Volts. It may cause an electrical shock while assembling with the inverter. Do not disassemble the module or insert anything into the backlight unit.
- (2) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contact with hands, skin or clothes, it has to be washed away thoroughly with soap.
- (3) After the module's end of life, it is not harmful in case of normal operation and storage.

### 10.3 SAFETY STANDARDS

The LCD module should be certified with safety regulations as follows:

- (1) UL60950-1 or updated standard.
- (2) IEC60950-1 or updated standard.
- (3) UL60065 or updated standard.
- (4) IEC60065 or updated standard.

## 11. MECHANICAL CHARACTERISTICS

